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*Cotton Spinning and Manufacturing
in the United States of America*

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Cotton Spinning and Manufacturing in the United States of America

A REPORT

*To the Electors to the Gartside Scholarships on the results of
a Tour of the American Cotton Manufacturing Centres
made in the Winter of 1903 and Spring of 1904*

BY

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The amount of a scholarship in respect of the time spent in England is at the rate of about £80 a year, during residence on the Continent of Europe at the rate of about £150, and in America at the rate of about £250 a year.

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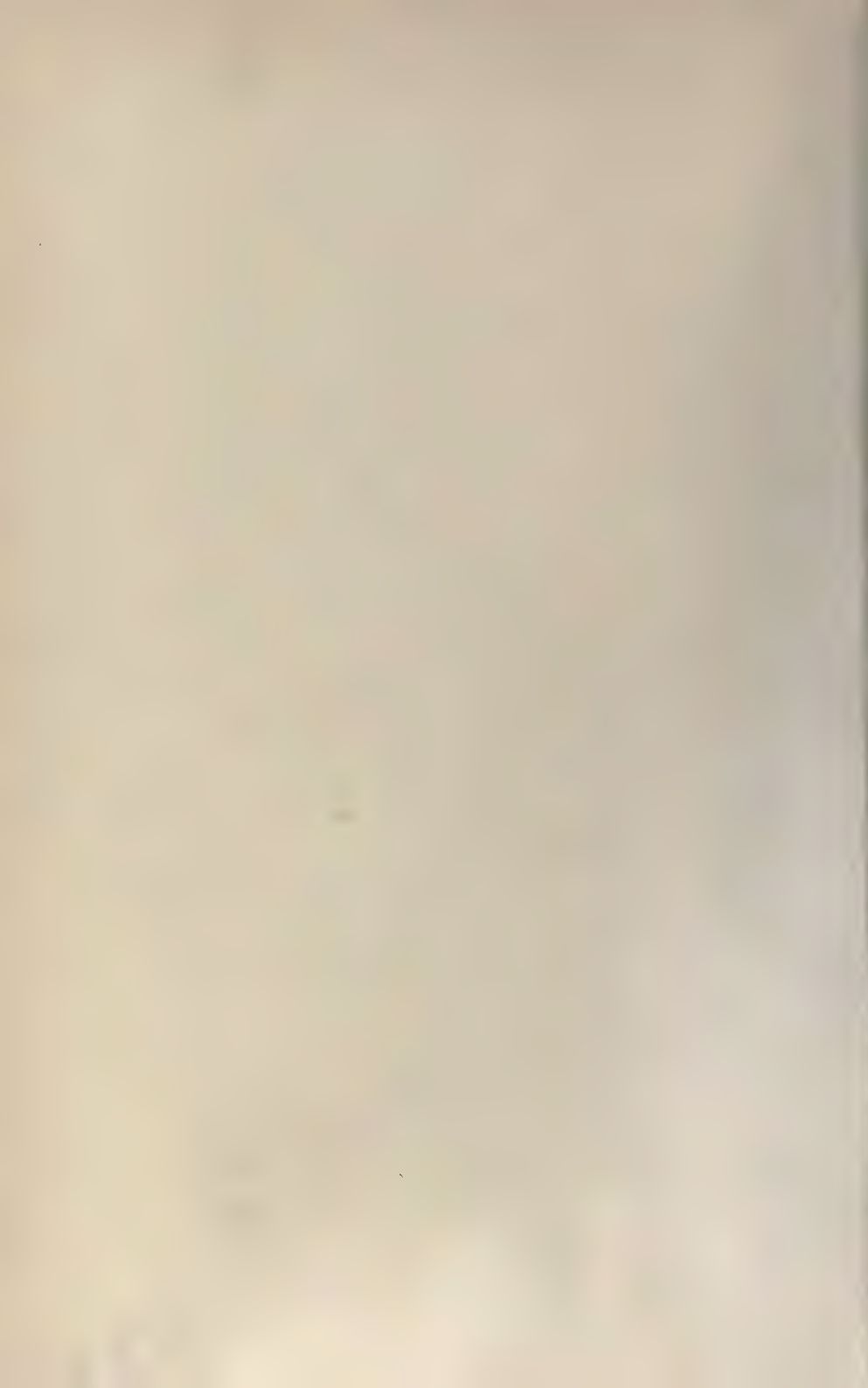
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Cotton Spinning and Manufacturing
in the United States of America.

PART I.

NEW ENGLAND.



I.

LAWRENCE, MASS.

Concentration of manufacturing in New England—

Frame spindles increasing more rapidly than mules
—Water power—The Pacific Mills—Percentages of
the different nationalities in a mill—A trial of
plain and Northrop looms—Work and wages in the
different departments—Double carding—Slashing
machines—Rents and cost of living in Lawrence—
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but no back-tenters—Spinning wage compared with
New Bedford.

THE greatest and densest concentration of cotton manufacturing in U.S.A. remains, as it has been ever since the first operation of spindles by power at Pawtucket, in southern New England, and within a radius of 30 miles from Providence, R.I. Within this circle, which includes Fall River and New Bedford, there were, in 1809, a total of 78,906 spindles working or in contemplation—less than a quarter of those now contained in the Fall River Iron-works alone,—whilst in 1900 the census reports that there were within this area, 7,209,235 spindles, 30 per cent. of all the cotton spindles of the country being concentrated in two adjoining counties of Massachusetts and Rhode Island. Fall River stands at the head of the list, with an annual product of a value of \$29,286,526, and the principal cotton cities of the country, judged by the value of their

product, appear in the following order:—Philadelphia, Lowell, New Bedford, Manchester, Lawrence, Pawtucket. From the start Massachusetts has always been the greatest consumer of cotton, but now her advance is not so rapid as that of the younger South, and the percentage of New England has dropped from 81 to 67 per cent. of the spindles of the whole country between 1880 and 1900. The cotton mills of U.S.A. contained in 1900 19,008,352 spindles, an increase of almost 34 per cent. over the number reported ten years before; in New England there has been an addition of 2,014,832 spindles or 18·6 per cent., and in the Southern States 2,744,188 spindles or 176·6 per cent.

A noticeable feature of the growth in spinning is the very slow increase in mules as against the rapid advance in ring spinning, probably explained not so much by the substitution of frames for mules as by the fact that practically all the new spinning—especially in the South—is on frames; in New England during the decade 1890 to 1900 the increase in mule spindles was less than 100,000 as against nearly two millions on frames, whilst in the South mule spindles advanced only from 108,474 to 180,534, with an addition of almost 2,700,000 frame spindles. In one State, Rhode Island, there has been an actual decrease of ring frames and an increase in mules, owing to the fact that the mills of this State spin a large amount of fine counts and also produce yarns intended for hosiery purposes. This significant growth of ring spinning is due to the high state of development to which the ring frame has been brought in America, coupled with the fact that this system does not necessitate the employment of such skilled operatives as the mules require; there is, however, little doubt that the troublesomeness of the mule spinners' union has also had some influence as a determining factor in the extension of another mode of spinning, where the hands are more easily trained and replaced.

Many of the principal cotton manufacturing cities of

New England owe their development to water power, which supplies 655,931 h.p. or 35 per cent. of the total amount used in the varied industries of these six States; of the total power used in New England in cotton manufacturing alone, water power constituted 32.6 per cent. in 1900, and so forms by no means an insignificant factor in the history of the industry. The largest individual power on the Connecticut is at Holyoke, where from a fall of 58 feet, 30,000 h.p. is supplied to a number of mills, largely devoted to paper making, whilst Lewiston derives 12,615 h.p. for use in her mills from the Androscoggin falls. Up to the present, however, the powers on the Merrimack River have been the most fully utilised, developing some 100,000 h.p., which has been the cause of the rise to eminence of such cities as Lowell, Lawrence, and Manchester along its banks; the growth of these towns has been along similar lines, all having been laid out by engineers for manufacturing cities, whilst a system of canals has been built to bring the power from the main river to the mills. In the Northern States water seems as yet to have been very little used to develop electric power for driving the cotton mills, but its adoption in the future will doubtless lead to still further use of water powers, including those at present useless on account of their location. In Lawrence alone, where the writer had an opportunity of visiting one of the older corporations engaged in cotton manufacturing, some 18,000 h.p. is derived from the system of canals originally built, and still controlled by the Essex Co., whose enterprise in harnessing the powers of the Merrimack has resulted in the present city of over 60,000 inhabitants, where little over half a century ago was a village of some two hundred people. In this city, where there are cotton factories with an aggregate capital of \$8,450,000 and plants totalling 424,676 spindles and 11,847 looms, water supplies 36 per cent. of the whole power used in the industry.

The Pacific Mills at Lawrence consist of four main brick buildings, standing in parallel lines beside the power canal, from which they derive about half of the 4,000 horse power required to drive their 98,608 spindles (60,880 on ring frames) and 4,040 looms. The company, which was established in 1852, has a capital of \$3,000,000 and gives employment to over 5,000 hands in its mills, where print cloths and "fancies" are manufactured. The operatives here, as in most mills in Massachusetts, represent a great variety of nationalities. At the Pacific Mills they are chiefly French Canadians and Irish, but at a Lowell mill, employing 2,300 hands, I have been furnished with the following percentages of the different nationalities, viz.:—Irish, 45·52; French, 19·92; American, 10·94; Greeks, 7·53; other nationalities in smaller numbers, 16·09. On the fly frames, I am told, the hands change least of all, a number having been there for some 30 years, but in the weaving-rooms changes are very frequent, for the union is stronger, and the weavers leave the mill if dissatisfied with the work given them, knowing that there is always a demand for a good weaver.

At the Pacific Mills I was interested in a trial of Draper (*i.e.*, Northrop) looms against one of the best known makes of American plain looms. The first test was on a 68 square 39 in. plain cloth, a cheap dress material, with 28's warp and 36's weft, on which the Draper looms ran at 160 picks and the plain looms at 153, each weaver looking after sixteen of the former or seven of the latter. There were the same warps on each, and no drop-wires on the plain looms, but the Drapers had the advantage both of speed and of "bobbin filling" (ring weft), whereas the ordinary looms had cop weft. For the cut of $54\frac{1}{2}$ yards slasher length (50 in the cloth), the weavers' prices compared as follows:—Drapers, $8\frac{1}{4}$ d.; plain looms, $15\frac{1}{2}$ d. On the plain looms the amount of cloth turned out was 30·35 yards per loom per day, whilst the output of the Drapers was 32·89

yards, and in the overseer's opinion the latter made less imperfect cloth.

Another test was on the standard 28in. 64 square print cloth, with the same warp and weft as for the previous cloth. In this case the plain looms ran at 195 picks per minute with eight looms to a weaver, whilst the Drapers ran at 183 with 18 looms per weaver. Here the plain looms had the advantage in output per loom, their product amounting to 48·37 yards as against 45·89 yards on the Drapers, and in this case both had "bobbin filling" alike. The weaving prices for the cut of 58½ yards slasher length (54·40 in the cloth) were 11½d. on the plain looms and 6¼d. on the Drapers. For these tests weft was brought to both kinds of looms, and the Draper weavers had to keep their own magazines full, the only difference in working being that the plain loom weavers had to clean their own looms, whereas there was a cleaner to every hundred of the automatic looms; there was an oiler for every 500 or 600 of both kinds of looms. On the narrow looms tacklers looked after 150 plain looms, 115 of the narrow Drapers, or 112 of the 40in. Drapers. The "fancies" made here consist largely of cords and lenos. The dobbies run at 165 (36in.) and 154 (40in.) picks a minute, with six and seven looms to a weaver and 85 to a tackler, and the tacklers are paid so much per hour, making weekly wages of 52s. on plain looms and about 54s. 6d. on dobbies. The supervising staff for all the weaving-rooms consists of one chief overseer, two second hands, and two third hands.

Going through the other departments of these extensive mills, I found the picking-room fed by "conveyors" from two sets of six bale breakers, placed in rooms on opposite sides of it, one man feeding each set, with two others to help and look after the waste here and in the picking-room, besides running the roving waste breaker. The equipment of the picking-room consisted of 12 exhaust openers, with intermediate and finisher scutchers to go with them, which

together put through about 150,000 lb. a week, and the staff was made up of a foreman and ten pickermen, the latter earning $11\frac{1}{2}$ cents an hour, or 27s. 9½d. a week. There was no overtime work for cleaning in this department, as this was done on Saturday morning and at nights, when the machines were stopped a little earlier.

The carding is worked on the double carding system, with stationary flat cards, which, though getting on for thirty years old, are still turning out good if not very rapid work. One-half of the room is taken up by 120 breaker cards, the slivers from which are run together at the ends of the rows to a lap head, making laps for the 120 finisher cards on the other side, and the slivers from the finishers are run together in tens in the railway heads. The output of the finisher cards is about 360 lb., but there are 84 cards with flats almost completely encircling the cylinder which, I am told, equal in output 120 of the others. This arrangement of cards is duplicated in another part of the mills, and, with extra cards for use when grinding, the total is 336 breaker and 378 finisher cards. The other machinery attached to this department consists of three lap heads and 36 railway heads, the latter fitted with a trumpet "evener" motion and cone strap drive. The cardroom hands are a foreman and second carder; a man for card clothing and repairing; 12 grinders, earning 38s. 2d. a week; 19 strippers, whose work it is also to put the laps on the cards, and who earn 27s. 9d. a week; a lap carrier at the same wage as a stripper, to bring in laps from the picker-house; two men, each earning 33s. 10d., to oil and sweep for the cardroom and picker-house; three lap boys, working on the lap heads, and six "railway hands."

On the two sets of drawing frames, where three ends are put up for one delivery, there are six tenters to look after 156 deliveries, at a time wage of 20s. 6d. a week. The slubbing tenters look after a pair of frames of 52 spindles

each at $3\frac{1}{4}$ d. per hank per spindle of 0·47, and the output averages 64 hanks per spindle, making a weekly wage of 34s. 8d. The intermediate frames have 80 spindles and the roving frames 144, the tenters having two frames a-piece, and the rates of payment are respectively $3\frac{1}{4}$ d. and $4\frac{1}{2}$ d. per hank per spindle for 1·25 and 4-hank roving. The output is 57 and 48 hanks per spindle, making weekly wages of 30s. $10\frac{1}{2}$ d. and 36s. for the intermediate and roving frame tenters—considerably more, I think, than they earn in an English mill. There are no back-tenters or creelers on these frames, but for the whole department there are two bobbin carriers (earning 27s. 9d. each), two oilers and wastemen, two sweepers, and a scrubber. In the spinning-room they run the ring frames with eight to twelve sides of 80 spindles to a tenter for 28's warp and 36's weft, and they pay $5\frac{9}{20}$ d. per side, per day, giving wages varying from 21s. 9d. to 32s. 8d. a week; both these counts are spun from 4-hank roving, the cotton being "middling" quality. The twist put in is 23·94 turns for the 36's weft and 25·72 for the 28's warp, and the output per spindle is 1·5 lb. of the former and 1·29 lb. of the latter. The doffers here are in the proportion of four to 10,736 weft spindles, or $33\frac{1}{2}$ sides each, and they are paid 25s. $4\frac{1}{2}$ d. per week—again a pretty high wage.

Coming to the preparation for weaving, I found the winders looking after a side of 60 spindles, being paid at the rate of so much for every box of full bobbins used. On 28's, I was told, the box held "about" 43 lb., and at $7\frac{3}{10}$ d. per box the winders' wages average 25s. $4\frac{1}{2}$ d. a week. The warping machines here run at 36 revolutions of the drum (18in.) per minute, and the warpers are able at this speed to run four machines each without any extra creelers, and to make a wage of 36s. 8d., the price being $5\frac{1}{10}$ d. per 100 lb. for 28's warp of 360 ends. The bobbins are set parallel to the line of the creel, which makes it much easier to get at them for piecing, and enables a larger number of bobbins

to be put in the same size of creel. The bobbins are set in glass steps, and the yarn is drawn off from them across vertical glass rods set in the creel framework.

The slashing for these mills is done by some six or seven machines, the best being three on the Howard and Bullough pattern with some devices added. Over the large cylinder and size-box are hoods connected with an exhaust to draw off the superfluous moisture, and some trouble has been taken in arranging the cylinders so as to drain easily. The cylinder ends are packed with magnesium, so that little heat is lost in this direction, and roller bearings enable the machines to turn with great ease. Two pipes lead from the size-mixings to each machine, one containing heavy starch size, the other light corn size, so that any mixing required can easily be made at the machine. With 10 lb. pressure of steam they are able to run these machines with 1,800 or even 2,000 ends of 28's at a rate of over a yard a second—58½ yards in 53 seconds, to be precise,—and a slasher tenter looks after two machines, with an assistant. The slasher-men here are on a time wage of 54s. 10d., their assistants earning 32s. 10d. a week.

In view of the general high range of wages earned here, I made some inquiries about rents in Lawrence, and learnt from one of the mill officials that corporation (*i.e.*, mill-owned) houses let for 8s. 4d. a week (including rates and taxes) for four rooms on one floor, the houses being in blocks, with an upper and lower tenement for each door. The rent of a house of six rooms, complete in itself but one of a block, is 11s. 5½d. a week; three-storey houses in a block, occupied mostly by overseers or second hands, have nine rooms and a shed each, and let for 16s. 8d. a week. In the mill boarding-houses the cost for a week's board and lodging is 10s. 5d. for women and 14s. 7d. for men. The corporation houses, which are built of brick, are let for rather less rent than those not owned by the mills, but they are limited in number, and the millowners

are gradually getting rid of their tenement property, which they originally built to attract the "help" to the mills. A number of the operatives own the houses they live in. From another source I learnt that it would cost \$1,500 (£312. 10s.) to build a six-roomed wooden "frame" house of the type so common in the outskirts of Lawrence, the rate being about £52 a room; this would be exclusive of the land, which would cost about 8d. a foot and upwards.

In the same city I also saw a mill devoted entirely to spinning, from low hosiery counts up to 80's, averaging about 40's and mostly on combed yarns. There are about 63,000 ring spindles and six pairs of mules, but the latter, already reduced from twelve, are out of date, and are shortly to be replaced by ring frames; incidentally I am told that the operatives' unions do not cause much trouble, but that it has always been necessary to "keep one eye on the mule spinners." This year the mill I am describing has followed out the practice of many of its neighbours and bought in or ordered on "contract," at the beginning of the season, a supply of cotton almost sufficient to last throughout the year, and the three floors of its warehouse are now filling up rapidly. For such a variety of counts a wide range of cotton is required, varying from $1\frac{1}{4}$ in. S.M. for 40's and $1\frac{3}{8}$ in. G.M. for higher counts to the $1\frac{9}{16}$ in. Sea Island from which 80's is spun, whilst some Egyptian is also employed.

The picking-room has six lines consisting of opener, intermediate and finisher scutcher, the intermediate being fitted with the three-blade beater, and the whole department is worked by six hands, each earning 32s. 11d., whilst the head-picker is paid 50s. a week. For cleaning purposes the machines are stopped on Saturday about 8 o'clock as well as, every day, ten minutes before noon and a quarter-of-an-hour before shutting down at night. The majority of the cards are of a well-known English make, though a few of the newest additions are American and turn out

about 5 per cent. more work, but the quality of the sliver produced is, I am told, in no way better. Six strippers look after the 128 cards, oiling, stripping four times a day, and having each 6 laps to keep going, earning a weekly wage of 32s. 11d.; lap tenters run 18 cards apiece, for which work they are paid 30s. There are two grinders, at 37s. 6d., to keep the whole equipment in order, the hard-tempered cards being ground every two weeks whilst the old soft-tempered cards are run over every week. These cards turn out 540 lb. a week on Egyptian and low American, and about 320 lb. on Sea Island. The combers are of four different makes, but the majority are Hetherington's, working at an average of 90 nips a minute, and a girl at a wage of 33s. 9d. tends 8 frames of 6 laps each. On the two sets of drawing frames there is a girl to look after 20 deliveries, back and front, her weekly wage being 25s. 5d.

Coming to the fly frames, I found tenters looking after one slubbing frame of 90 spindles at a standing wage of 30s. 2½d., and the output per week on $\frac{3}{4}$ hank roving would be about 65 hanks. The intermediates have 90 and 120 spindles to the frame, and tenters look after 2 frames each, and are again on a standing wage, 32s. 6d. or 37s. 6d., according as they are on the shorter or longer frames; I am told that on the fly-frames here they find much better work is turned out if the hands are on time wages instead of piece rates. On 2-hank roving a production of 55 hanks a week is obtained on the longer frames. The roving frame tenters, also with a pair of frames (152 spindles) each, are paid 32s. 6d., and get off a production of 44 hanks per week on 5-hank roving. On these frames, I noticed, there is no help in the way of back tenters, but it is generally the custom in the American mill to provide a set of doffers to assist the tenters; in the present case there are 6 doffers, earning 22s. 6d., for 60 frames. The jack frames have 180 spindles and tenters

run two frames each on 14-hank roving, earning 31s. 3d. weekly. In the spinning-room I find the frames of such different lengths and the counts in such great variety that it is difficult to find a standard, but the average, I am told, is for a spinner to mind 6 sides amounting to 800 spindles, the wage for this being 27s. 6d.; the rate at a New Bedford fine spinning mill is much lower than this, viz., 19s. 10d. for 800 spindles, but the spinners run 12 sides of 112 spindles each and earn 33s. 4d. for the week's work. On 70's twist, the only count on which there is a fair number of frames, spinners look after 6 sides aggregating 880 spindles at the standing wage of 27s. 6d., which is the same for all counts varying from 20's to 80's; on the coarser hosiery work, however, the number of sides is cut down whilst the wage remains the same. It is found best, I understand, to put the doffers on a kind of piece rate, and accordingly they have a fixed wage of 2d. per frame, averaging 264 spindles. By using a fairly good staple cotton they are able to run the frames at a very high speed, but the twist put in— $4\frac{1}{4}$ times the square root of the count for warp—is, I believe, rather more than is customary in an English mill.

II.

LOWELL, MASS.

A large corporation—Power from the Merrimack—Hours and holidays—Strippers as can tenters—Rates and productions on fly frames—Doffers and back-boys instead of piecers on the mules—Warpers on six machines—System of keeping skilled hands to skilled work—Drawing-in compared with twisting—Weaving on Northrop looms—Why tacklers are on time wages—A printworks—Organisation of hands on the machines and average runs—No union men—Engraving department—A corporation boarding-house—A bill of fare.

At Lowell I visited one of the older corporations, a firm with a capital of \$2,500,000 and plant of some 140,000 spindles and 4,000 looms, which employs about three thousand hands in the manufacture of prints, shirtings, corduroys, lenos, crepes and flannels; the counts spun range from 9's to 90's weft and 9's to 60's twist. In the fall and spring there is often sufficient water from the power canal to drive the whole of the mills, viz., 3,000 h.p. distributed to 7 water-wheels, which turn the shafting direct, but at other times a certain amount of auxiliary steam power has to be employed. By their position these mills have the unique advantage of drawing from the higher level of the power canal and discharging direct into the Merrimack, instead of into another canal on an intermediate level, thereby obtaining the benefit of the full fall of some 35 feet. The holidays observed here are

Patriot's Day (19th April), July 4th, Christmas and Thanksgiving Days, with sometimes May 30th and Labour Day (1st Monday in September) as well; the hours of work for Massachusetts are fixed by statute at 58 per week, the usual division being from 6-30 to 12 and 1 to 6, stopping on Saturdays at noon.

In these extensive mills there is a formidable array of bale breakers, which convey the cotton by means of cleaning trunks to the mixing room, this department and the blowing room being superintended by an overseer who earns £5 a week, whilst the pickermen are paid at the rate of 29s. 2d. In the card-room, which puts through from 350 to 450 bales of cotton in the week, strippers, earning 29s. 2d., look after 16 cards apiece, but as is sometimes the custom in American mills, they have to act as can tenters as well. A grinder (45s. 10d.) with an assistant (31s. 3d. to 33s. 4d.) looks after a section of 84 cards, which are ground once in four weeks and stripped three times a day. On short-staple cotton the cards turn out 900 lb. a week, on long-staple from 350 to 500 lb.

Coming to the drawing, the tenters run three frames (15 deliveries), back and front, at a standing wage of about 22s. 11d. Tenters on slubbing have each two frames, with mostly 60 spindles, and with an output of 142 to 144 hanks of 70 at 2'97d. their average wage will amount to 35s. 4d. On the intermediates tenters look after two frames of 92 spindles and, at the rate of 4½d. for 1'60 hand roving, earn an average wage of 30s. 11d. from a production of 44 to 46 hanks. The roving tenters have two frames of 160 spindles, without the assistance of a back tenter, making 4'80 hank roving, for which they are paid 3'95d. per hank, so that from a production of 44 to 48 hanks their earnings would average 30s. 3d. for the week. Jack-frame tenters have three frames of 168 spindles each, with only the assistance of learners to help doff; on 16 hank roving they received

30s. $10\frac{1}{2}$ d. for an output of 24 hanks per frame, the price being 5'15d. per hank. Intermediate frames run at a flyer speed of 900 revolutions and roving frames at 1,250, whilst the jacks make a speed of 1,350.

In the spinning department I found the tenters running an average of eight sides of 104 spindles, making 8,500 revolutions, at a standing wage of '64d. per side per hour, which figures out at a weekly wage of 24s. 9d., as against 28s. 3d. which the Lawrence spinner earns on this number of spindles. Doffers are in the proportion of one to 3,000 spindles, doffing fifteen times a week, and they are paid 26s. 3d. The mules are worked on a common American principle, *i.e.*, with a supply of doffers and back-boys, but no piecers; the English minder going over there, I am told, finds he has much harder work to do, when deprived of his big and little piecers. There is a minder to each pair of mules (1,440 spindles), with two doffers (26s. $0\frac{1}{2}$ d.) to 24 pairs and a back-boy (18s. 9d.) to between 3 and 6 "quarters"—four "quarters" constituting a pair of mules. On 90's weft a minder will turn out 40 hanks per spindle per week, which at $16\frac{1}{2}$ d. per 1,000 hanks gives a weekly wage of £3 19s. 2d., out of which nothing is deducted to pay either doffers or back-boys, so that although the minder has to work hard he earns a pretty good wage.

On 28's twist the winders, equipped with a Barber knotter, look after 55 spindles each, being paid at the rate of $17\frac{1}{2}$ d. per 100 lb., and as they put through about 1,600 lb. in the week they will be earning 23s. 4d. Warpers each tent six machines, running at 60 yards a minute, with the assistance of 9 to 12 girls to creel for 36 machines; the price paid is 1'05d. per warp of about 320 to 400 ends on any counts from 28's to 60's, and warpers will generally earn 31s. 3d. a week. This is, of course, the usual method of running the warping machines in the American mill, *viz.*, to provide extra help and give more machines to each

tenter, and the American mill man, untrammelled by standard lists, finds it hard to believe that the English warper runs only one machine. The system holds largely throughout the American mill; by means of extra doffers, creelers, etc., the skilled hands are enabled to confine themselves to greater advantage to the more skilled work on their machines and so run more of them, leaving doffing, creeling, sweeping, etc., to younger and less skilled help, a method of organising the hands which the American manager considers more economical even if it necessitates running the machines rather slower.

A peculiar feature in most of the mills is the preponderance of drawers over twiststers, the latter being more expensive help and apparently less reliable. At the mills in question I was told the twiststers were mostly English and the "toughest" lot in the mill, being very unreliable and intemperate. For drawing-in, which is always done single-handed without any reacher-in, the print cloth standard is 7·7d for a warp of 1,765 ends (28's), whilst for twisting 7½d. is paid for a thousand ends.

Coming to the looms, I found 252 Drapers working on corduroys, a standard production here. Running at 150 picks, the weavers are able to look after 16 looms on 31-inch goods, earning 45s. 10d. to 50s. a week; so that they can confine themselves to weaving and need not leave their looms, there are eight boys, earning about 12s. 6d. a week, to bring weft and keep the magazines filled, besides three cleaners and oilers who are paid about 25s. On the narrow plain looms making print-cloth, running at 190 picks, weavers have each eight to ten looms; the price for a 53½ yards cut of the standard 28 inch 64 square print cloth is 10½d., and weavers earn from 29s. 2d. to 33s. 4d. a week. Loom tacklers are on a standing wage varying from 45s. 10d., to 62s. 6d. One explanation given me for the fact that tacklers are, as a rule, on time wages is that in the summer months many of the best weavers are away on

vacation and have to be replaced by the "sick help," so that the tackler would suffer from the change if paid on percentage on his weavers' wages. On dobbies the weavers run 4 and 6 looms on lenos and 8 on flannels (10 harness), averaging \$9 and \$10 a week on 6 lenos, weft being brought to the looms in all cases.

Among the group of buildings comprising these large mills there is also a printworks of 24 machines, printing cloth made by the looms of the same company as well as "converting." Many of the machines are only for one-colour work, but there are also two 6, one 7 and two 12-colour machines, which are run till 5 o'clock at night without any stoppage for meals. An average order for a shirting on a one-colour machine is, I am told, 1,500 pieces (50 yards each) in four colourings, and the machine will turn out 500 to 700 pieces a day; on a two-colour machine an average run is 600 pieces in 4 combinations, an output of 250 pieces a day being obtained. Each machine has a printer and back-tenter, the duty of the latter being to wash the rollers, put the rolls up and attend to the colour box. To every three machines there is a spare man to help put the rolls up, clean the colour box out, etc.; the back-tenter is paid from 33s. 1½d. on the smaller machines to 36s. on the largest, the spare man earns 29s. 2d., whilst the printers are on time wages varying from 37s. 6d. to £5. 16s. 8d., according to their skill. No union men are now employed as printers here, as they demanded the higher of the two figures for each journeyman and refused to work with non-unionists, who have now replaced them. One of the cleanest and brightest parts of the whole mill was the engraving department, where girls were seated at the 22 pentagraph machines, at which work they earn 25s. 10d. a week. For the finer effects there are 6 die cutters (£5. 16s. 8d.) and 7 machine engravers (£5 to £5. 8s. 4d.), whilst to touch up the pentagraph work there are three hand engravers earning £5. 4s. 2d. a week.

My visit to Lowell was concluded by a look into one of the corporation (*i.e.*, mill-owned) boarding-houses, which are quite a feature of the older New England mill towns. Most of the older corporations used to own a considerable amount of property around their mills, to provide housing for the operatives in the old days when they had to come from a long way to their work, but a large proportion of the tenements are sold now, and the corporation boarding-house, too, seems to be passing away. Mrs. D., the boarding-house keeper, has four brick tenements, each with 15 bedrooms, which the corporation rent to her for £3. 10s. 10d. a week, which includes taxes, but not water—from £10 to £12 a year extra; this is not, of course, a competitive rent, but it is part of the mill policy to support the boarding-house and to keep on what is really almost dead property for the convenience of the hands. Mrs. D. is able to board and lodge 80 girls, and also provides dinners for some 40 or 50 men and women, all at a very moderate cost. A girl can have board and a room to herself for 8s. 4d. a week, whilst if she shares her room with another girl it will only cost her 7s. 3½d. Boarders have to make their own beds and sweep their rooms, and facilities are given them for doing their own laundrying; fuel—oil or wood—is the only extra which they have to provide for themselves, but Mrs. D. is going to agitate for the installation of a steam heating apparatus. The following is the bill of fare—by no means meagre—provided for the boarders:—

Breakfast: Steak and potatoes; oatmeal; hot rolls, Graham bread, doughnuts; pie; tea and coffee. On Fridays, eggs and fish.

Dinner: Soup (Fridays, fish chowder); two kinds of hot meat, potatoes, and two vegetables; two kinds of pie, pudding and sometimes fruit; tea.

Supper: Cold meat; fried potatoes; hot rolls; cake, pie,

sauce; tea and coffee. In cold weather, hot soup or cereal is also served for supper.

There are two dining-rooms kept going, as a number of the hands simply board there and have a lodging elsewhere, the charge for these being 10s. 5d. for men and 7s. 3½d. for women. Altogether, with a high scale of wages, the Lowell operative living in one of the boarding-houses appears to be pretty well off.

III.

BURLINGTON, VT.

The Queen City Cotton Company—No unions—Freights on cotton—Hours and school regulations—Cost of building houses compared with the South—Spinning compared with Lawrence—Weaving on Northrop looms—92 to 95 per cent. production—Automatic v. plain looms on production of standard print cloth—Tackling costs double at Burlington—Interest and depreciation lessen advantage of Northrop looms.

At Burlington (Vermont), a town of some eighteen hundred people, situated on the shore of Lake Champlain, I was able to see the Draper (Northrop) looms in their first home. The Queen City Cotton Company, incorporated in 1894 with a capital of \$700,000, was one of the most modern and compactly arranged mills I had yet visited in the North, the spinning being all in a three-storey brick building and the looms on one floor in a weave-shed with saw-tooth roof. The two buildings house a plant of 55,008 ring spindles and 1,308 automatic looms. Vermont being mainly an agricultural and quarrying State, I was curious to know the object of building a mill so far out of the way; the nearness of water power was evidently not the attraction, for the mill is driven entirely by steam. The reason given me was that in Vermont they could get cheap labour, and there were no factory laws and no unions to give trouble over the trial of a new machine. The remoteness

of these mills is, I understand, not such a serious disadvantage as might be expected, the freight for cotton to Burlington being the same as for Lawrence—200 miles distant—and other Massachusetts towns, as they all come under the heading of “Boston points.” Though there are, strictly speaking, no factory laws in the State, it is the custom to work sixty hours a week, from 6-30 a.m. to 6-15 p.m., with an hour’s stop for dinner, and closing down at 12-45 on Saturdays. There is a school regulation that children under fifteen are not to be employed unless they have attended school for 36 weeks in the year; in special cases, where a child’s help is needed for the support of his family, he may be allowed to work in the mill on obtaining permission from the superintendent of evening schools. The holidays observed at the Queen City Mill are May 30, July 4, Thanksgiving, Christmas, and New Year’s days, and the mill generally shuts down for the day when a big “show” visits the town. The hands employed here are mainly drawn from the district, with a sprinkling of French Canadians. The mills being situated a good mile from the town, the Company had to build a number of tenements for their hands, to whom they let them at the rate of a dollar per room per month. To build one of these four-room tenements would cost, I was told, from £150 to £200, as against about £60 in the South, where, however, the houses are without foundations, simply being perched on brick legs, whilst they are often as innocent of paint or paper inside as they are of piping for water, gas, or drainage.

In the spinning-rooms at these mills spinners were running eight to ten sides each on the twist frames or six to eight on weft, two-thirds of the frames having 120 spindles a side, whilst the rest were slightly longer. “Rivers” cotton of $1\frac{1}{16}$ in. to $1\frac{1}{8}$ in. staple was being used for both 28’s twist and 39’s weft, the grades being respectively strict low middling and middling, and on the

twist counts a production of 1·23 lb. per spindle per week was obtained. On the warp frames spinners are paid 4s. 3½d. a day for minding 1,000 spindles on 28's, and on weft (39's and 40's) the price is 5s. 2½d. for the same number of spindles, giving weekly wages of 24s. 8½d. to 30s. 10½d. on warp and 22s. 6d. to 30s. on weft. At Lawrence the rate was 5s. 8½d. for 1,000 spindles, and the spinners got off a production of 1·29 lb. per spindle in a week of 58 hours, but they were given rather fewer spindles to tend than their fellows at Burlington. There were twelve doffers to look after 223 frames, and their earnings varied from 2s. 2d. to 4s. 2d. a day. In the warping-room I found warpers looking after seven to eight machines each, with the help of two or three girls to creel for fifteen machines. Warpors here are paid a time wage at the rate of 32s. 6d. a week for running eight machines, as against 36s. 8d. which the Lawrence hands earned on piece rates running four machines, but without extra creelers. Drawers-in were paid as follows for a beam of 1,792 ends of 28's:—For steel harness, 8d.; for cotton harness and drop-wires together, 10d.

Coming to the weave-shed, I found all the narrow looms, 850 in number, running on print cloth, whilst two-thirds of the 40in. looms were on satteens and the rest on prints and fancies. The 30in. looms ran at a speed of 174 picks a minute, and weavers had 16 to 20 looms apiece; but, as is the common method of working automatic looms in an American mill, they confined themselves entirely to weaving, and other hands were provided for other duties. The extra labour employed on the narrow looms consisted of three "filling" hands, to distribute weft to the weavers, but not—so I was told—to assist them in keeping the magazines full. Cleaners and oilers looked after 140 to 150 looms each. There were, besides, two "room girls," to assist weavers in case of smashes, but I was told that the firm intended to reduce the number to one. Wages were

paid as follows :—Two weft carriers 25s., and one 12s. 6d.; cleaners and oilers, $\frac{3}{4}$ cent per loom per day, giving a weekly wage of 26s. 3d. to 28s. 1½d.; room girls, 33s. 9d. per week. Eight tacklers at a wage of £2. 10s. a week looked after these looms, and there were an overseer and second hand to supervise the whole room. For a 50 yards cut of 28in. 64 square print cloth, with 28's twist and 39's weft, weavers were paid 4 $\frac{2}{3}$ d., as against 9 $\frac{9}{10}$ d. paid for a cut of rather over 56 yards on plain looms in Fall River.

The 40in. looms at the Queen City Mill were running at 154 picks, and each weaver had 16 looms to look after, with two hands to distribute weft and a cleaner to each 150 looms; tacklers ran 91 looms and received the same wage as those on the narrow looms. The wage-list for the broad-loom weavers showed weekly earnings varying from 38s. 3½d. to 50s. 1½d. A common satteen woven on the broad looms was a 39in. 64 by 112 cloth (3·75 yards to the pound), with 28's warp and 40's weft, for which 1s. 0½d. was paid for a cut of 52 yards. The actual production obtained here for time run is, I am told, from 92 to 95 per cent. of the theoretical maximum, but by starting up about a quarter of an hour earlier both morning and afternoon the output often exceeded the theoretical maximum for the nominal 60 hours.

At Burlington I was told that with the Draper loom they calculated they could make print cloth at a cent a pound cheaper than the plain-loom mills of Fall River, after taking everything into account; but from information I have collected in both places I do not think the advantage of the automatic loom would be so much. Taking an output of 5,400 yards of the 28in. print cloth, which was given me as a fair production on 20 Draper looms, I have figured out the cost in wages for weavers and extra hands as compared with a mill with only plain looms. At the Fall River mill which I have chosen for comparison, weavers looked after eight looms running at 210 to 220

picks, cleaning and oiling their own looms, and their output per loom per week was six cuts of rather over 56 yards. Tacklers had 200 looms each and were paid 56s. 8d., whilst there were four weft carriers, each earning 25s. a week, for the whole 1,848 looms in the mill. The wage bills work out as follows for the production of 5,400 yards of cloth:—

Burlington. Week's Wages on 20 Draper Looms.				Fall River. Week's Wages on 16 Plain Looms.			
	£	s.	d.		£	s.	d.
Weaver	2	2	0	Weavers	3	19	6½
Weft carriers ..	0	1	5½	Weft carriers ...	0	0	10
Tacklers	0	9	5	Tacklers	0	4	6
Cleaners and oilers	0	3	9				
	£2 16 7½				£4 4 10½		

In these estimates I have omitted consideration of the room girls employed in the Vermont Mill, as the “smash hand” is quite a common feature of the American weave-room, whether the looms are automatic or not. It is interesting to note that the cost for tacklers on the automatic looms is more than double that at Fall River; the wages to be paid for weft carrying are also higher, as the Burlington weft carrier only looked after 283 looms on an average, as against 462 on the plain looms at the Massachusetts mill—an astonishing difference if, as I was told, they had not also to help in keeping the magazines of the automatic looms filled. The cloth made at Fall River had a nominal 36's weft, but it generally ran a little finer, so for purposes of comparison I have considered them to be identical cloths of seven yards to the pound—the weight given me at both the mills. On the wage bill, then, there is a difference of 28s. 3d. in favour of the automatic loom for the week's production of 5,400 yards, or 0.439d. (0.8 of a cent) per pound of cloth.

On labour alone the saving is not very far short of the cent a pound claimed, but there is also to be considered the

interest and depreciation on the extra cost of the Draper loom (£28. 10s.) over the plain loom (£10. 8s.). Taking the usual 6 per cent. for interest, I have added 5 per cent. for depreciation on the basis of the life of a loom being about twenty years. An additional 2 per cent. I have added to the Draper estimate for the following reasons, viz.:— First, because such a highly patented invention is constantly being improved on, and so it more rapidly becomes out of date; secondly, because the patent on the bobbin-changing device runs out in eight years, and it should then be possible to fit it to looms for a much smaller sum. The estimate now runs as follows:—

Burlington.				Fall River.			
20 Looms at £28 10s. = £570.				16 Looms at £10 8s. = £166 8s.			
	£	s.	d.		£	s.	d.
6 p. c. interest on £570 ...	0	13	1	6 p.c. inter't on £166 8s....	0	3	10
7 p. c. dep'ciation „ ...	0	15	4	5 p.c. dep'ciation „ ...	0	3	2
Add wages bill ...	2	16	7½	Wages bill... ..	4	4	10½
	£4 5 0½				£4 11 10½		

The difference in favour of the automatic loom is now only 6s. 10d. on the total production, or 0·106d. (a fifth of a cent.) on the pound, and I have omitted any consideration of the extra repairs, space, power, etc., required by putting in a larger number of automatic as compared with plain looms. Again, the Vermont Mill was working longer hours, something like 62½ hours, as against the statutory 58 in Massachusetts. The Draper loom, it would appear, will have to run at a higher speed, or be worked more economically, or come down in price before it makes so great a saving over the plain looms of Fall River.

IV.

FALL RIVER, MASS.

A print cloth mill—Cost of building and equipping—
Unions in Fall River—Attempt to secure a standard
list on prints—A 10 per cent. cut in wages—English
and American cards—Men economical as drawing-
frame tenters—Extra twist in rovings—High wages
for spinning—Looms running at high speed—Over-
seers—Light and ventilation from the roof—A fine
goods mill—Cost of building and starting-up—
Grouping of foreign hands in different departments
—The “Fall River drive” for spinning frames—
Mule spinning—Satteens, “linens,” and dobby work
—Warp stop motions.

THE next mill I shall describe is one of the older established print-cloth mills of Fall River, the centre of print-cloth production in U.S.A. The original mill was built about 1825, but seven years ago a new building was erected to be devoted entirely to weaving, whilst all the spinning was placed in the old mill; the cost of building and equipping a mill at the latter date was given me at \$11 a spindle, but I understand building would be much dearer now. The unions in Fall River are pretty strongly organised, and I learnt from the local weavers' association that about 40 per cent. of the weavers in the town belonged to the union; this is a larger proportion than would appear at first sight, considering that Fall River has such a “floating” population of operatives, who move about from

mill to mill and town to town. About two years ago an attempt was made to secure a standard list for print cloths in the Fall River mills, but the conference came to nothing, as those masters who used high grade cotton and had modern equipment refused to be tied down by mills less up-to-date than theirs. The mule spinners are, I believe, the only cotton operatives in the North who have been able to secure and maintain a standard list. A fine goods mill I visited had recently had trouble with its tacklers about the number of looms to be given to each, and had solved the difficulty by putting non-union men in their places, not the only instance I had met with which seemed to show that, though the hands are organised, there is often enough non-union help to take their places in case of a strike in a small department of a mill. At the time of my visit another mill under the same management was having trouble with the union because the looms had been equipped with warp stop motions, and weavers complained that they were given too many looms and could not earn the same wage as before; how the difficulty was settled I did not stay long enough to learn. The hands at the Fall River mills had just undergone a cut-down in wages of about 10 per cent., but it is pleasing to note that this reduction, which brings them back to the level of the other mills further north, was submitted to with a good grace as unavoidable.

Going through the different departments of the print-cloth mill in question, I notice that the cards are of well-known English and American makes, and the carder speaks highly of the wearing qualities of the former as compared with the American machine. On a section of 54 cards the hands are organised as follows: there are three strippers, who fetch their own laps from the picker-house, a grinder, and a can man. The drawing frames are run by men, a rather unusual method, 30 frames of 4 deliveries each being tended by 4 men at a wage of

26s. 8d. each, a system which was considered more economical than the usual employment of a larger number of boys or girls at a lower wage, say \$5; compared with the Lowell mill, for instance, it cost 106s. 8d. here for the 4 men, as against 183s. 4d. for 8 girls who would have been employed at Lowell on 120 deliveries.

On the roving frames, each of 176 spindles, tenters run a pair without any back-tenter, but with the provision of the usual doffers—four to 26 fly-frames. On $4\frac{1}{2}$ -hank roving the average production is 95 hanks, and the carder tells me they are putting in more twist now than they used to— $3\frac{1}{8}$ turns as against $2\frac{1}{2}$ —finding that it spins better this way, though the output per frame is rather reduced; the price per hank is $4\frac{3}{4}$ d., so that tenters make a weekly wage of 37s. 7d. In the spinning-room tenters mind an average of 8 sides on weft and 10 on warp, the newer frames having 272 spindles which run at 9,800 revolutions. For warp the price is 6'56d. and for weft 9'35d. per side, which figures out at average wages of 32s. $9\frac{3}{4}$ d. and 37s. $4\frac{3}{4}$ d. respectively—a rather higher wage than the spinners in Lawrence or Burlington were earning, but at the same time for a larger amount of work, whilst the output, 1'25 lb. per spindle on 28's twist, lies between the production at the two above-mentioned places. On the older frames of 240 spindles the scale of wages is lower, viz., $6\frac{1}{4}$ d. per side on warp and $8\frac{1}{4}$ d. on weft. Both 28's twist and 36's weft are spun from Middling cotton of 1 to $1\frac{1}{8}$ inch staple. The spinning is distributed over several rooms, and extra help is provided by two oilers and wastemen, a scrubber and seven boys for sweeping. The doffers—boys earning 25s. and 27s. 1d.—are in the ratio of 6 to 75 warp or 68 weft frames.

Three warping machines, running at a drum (18 in.) speed of 45 revolutions, are looked after by one girl, without any extra help for creeling, at an average wage of 38s. $6\frac{1}{2}$ d.; the Lawrence warper, it may be remembered, ran 4 machines making 36 revolutions and only earned

36s. 8d., so the Fall River tenters are not so badly off even after their cut-down in wages. The slashing machines run about 67 yards a minute, and there is one of them to each slasher tenter, who is on a time wage of 45s. 10d. This department stops early every night and on Saturday, so that the actual working hours for the week are only fifty-one. One man makes the size, doffs the warpers and helps the slashers for three or four machines.

Coming to the weave-room, I found the looms running at 210 (30 in.), 196 (36 in.) and 186 (40 in.), though 400 of the 30 in. looms were running at 220 picks, with 8 to a weaver in all cases, and there were no warp stop-motions fitted to the looms. For the standard 28 inch 64 square print-cloth 9⁹/₁₀d. is paid for a cut of 56 to 57 yards, and weavers run off 6 cuts per loom per week; the legal "margin" allowed is 1½ yards on a cut of 55 yards. On the 39 inch 68 square print, weavers will obtain a production of 4½ cuts of 54 yards per loom. For the last two or three years they have had several hundred looms here on a 28 inch 40 × 44 cloth, with 28's twist and 25's weft, for salt bags, etc., and I am told the 28 inch 64 × 60 is really more common now than the regular 64 square print-cloth. On the 30-inch looms six tacklers, at a wage of 56s. 8d. run 200 looms each, whilst on 40-inch looms they have 174. The other labour employed for the weave-rooms consists of 4 weft carriers, Portuguese, who earn 25s. a week. The supervising staff for the whole mill is as follows:—Weaving, an overseer and a second hand; carding, an overseer and second hand; spinning, an overseer and two second hands, a large staff owing to the fact that the spinning is divided among several rooms. The looms on the top floor here are lighted from the roof, a method which is quite common—especially in the South—for the top spinning floors of many mills, as it affords good light as well as ventilation to a broad room. This mill is heated by the Sturtevant system, and I am told that by passing the air in pipes

through a spray of water or steam, they are able to combine humidifying with the heating process; whether this is sufficient to moisten the atmosphere of a whole room I cannot say, but anything would be preferable to the introduction of live steam and the unhealthy atmosphere which one often finds in the older New England mills.

Fall River is noted for its numerous print-cloth mills, but it is perhaps not so generally known that it also contains quite a number of factories manufacturing fine goods and fancies, and that its climate is considered by many almost as favourable as that of New Bedford for fine spinning. One of these which I was able to visit, a mill with an equipment of 25,500 ring and 23,400 mule spindles with 1,080 looms in one compact building of the local granite, spins counts varying from 40's to 160's, with averages of 60's twist and 80's weft. The cost of building this mill, erected in 1895, including the equipment, power, lighting and land was given me as about \$13 a spindle, which included about half a dollar a spindle for starting-up.

As at other mills I had visited in Massachusetts, the hands here included a great variety of nationalities, and it is noticeable that they are roughly grouped together in separate departments. For instance, the French Canadians will be found largely on the ring frames, the blowing-room and cards are looked after by Poles or Portuguese, whilst English or Irish work on the mules, but in the weave-room there is no distinct race, though the French predominate in the mingled nationalities there. It is perhaps scarcely realised that few, if any, States of the Union have gained so much in point of numbers from the flood of immigration as Massachusetts; according to a statistical report of 1903 the hands of foreign descent employed in the cotton mills of the State amounted to 91 per cent. of the total number, French Canadians and Irish predominating largely over the other nationalities. In Fall River I was told there was no scarcity of labour at

all, and six new mills could be started up with hands in three months without much trouble.

The card-room at this mill, cut off by a partition of wood and glass from the fly-frames, contained 68 cards, looked after by a boss grinder and help, with 5 strippers, the boss grinder and his help earning respectively 41s. 8d. and 31s. 3d., whilst the strippers were paid 29s. 2d. to 31s. 3d.; though there are nominally five strippers, two really do all this work, stripping 4 times a day, whilst the other three put on the laps and look after the cans. All the yarns spun here are combed and put through four speeders, the machines in this department being well arranged so as to follow each other. The ring frames are driven by what is known locally as the Fall River drive—a long 70 ft. strap running on the shafting pulley, over two carrier pulleys above it, and down to the pulleys of two frames placed at right angles to the shaft line—a system which enables four rows of frames to be driven from two lines of shafting. This is a very neat arrangement of driving, but opinions differ as to its advantage, for it seems to be generally admitted that it is very hard on belts, whilst one cannot get away from the fact that with a slack side to the belts one set of frames must be driven at a different speed to the other. The frames have 136 spindles a side and all tenters look after 10 sides at 5½d. a side, therefore earning 27s. 6d. a week; in a Lawrence yarn mill, where they were spinning up to 80's combed yarns, the same wage was paid for 800 spindles, so the Fall River hand in this case is rather badly off by comparison, after the 10 per cent. wage-cut. The mules, of English make, have 1,300 spindles each, and are used solely for weft, as is generally the case in mills with both frames and mules. For nine pairs of mules there are 9 minders, 9 piecers, and 6 back-boys, the last two paid by the mill; minders earn from 62s. 6d. to 70s. 10d. a week, whilst piecers are paid about 33s. 4d. and back-boys 22s. 11d.

On the beam warpers one girl runs 3 machines and two 4 machines each, turning out a production of 9,000 lb. of 60's per week; there are no creelers to help, and all three warpers are on a time wage of 36s. 5½d. Coming to the looms, I noticed they all had some kind of warp stop-motion, electrical or mechanical, the former being, in the superintendent's opinion, less satisfactory and more easily put out of order, wilfully or accidentally, by careless weavers. On satteens, running at 175 and 180 picks for 33½ in. and 150 for 39 in., weavers have 12 looms each and earn an average of 50s. a week. On "linens," fine plain goods 80 sq. to 100 sq., averaging 80's twist and 130's weft, the speed is 170 picks for 32 in., and weavers run 8 and 10 looms each, averaging \$1 a loom, or 33s. 4d. to 41s. 8d. a week. For two-beam work weavers have eight 30 in. looms, which run at 175 picks. At the time of my visit the dobbies were running almost entirely on satteens, and tacklers looked after 112 to 120 of them, as against 70 which they would have for fancy work; on plain looms they minded 120 each, being paid 52s. 1d. a week. The other labour employed here to assist the weavers consisted of a man to bring weft to the weavers, and an oiler and cleaner to each 140 looms.

V.

NEW BEDFORD, MASS.

A CONNECTICUT MILL.

A fine goods mill with electrical drive—Ball-bearing bosses on fly-frames— Spinners better off than at Fall River—"Joiners"—Weaving with silk weft—Extra hands in the weave shed—Finishing system—Live steam as humidifier—A Northern mill settlement—Water and steam power—Labour laws of Connecticut—An unusual spinning-room—Organisation of hands on the mules—Weaving.

AT New Bedford, the home of fine spinning, I went through one of the newer mills engaged in the manufacture of fine goods, its present plant comprising some 24,600 ring and 44,000 mule spindles supplying 1,200 looms, though the equipment will before long be further increased. Here they spin combed yarns from 40's to 100's twist and 40's to 170's weft, the counts averaging 60's twist and 80's on weft. This is also one of the first northern mills I have seen which has adopted the electric drive, with a number of motors in each room supplied by the generators, which are connected direct to the steam engine.

On the jack frames at this mill tenters look after two frames of 200 spindles each, with no back tenter, but they help each other to doff; the average wage here

is from 35s. 5d. to 37s. 6d. a week. At a Fall River mill, on similar counts, I had noticed that ball-bearing bosses were fitted to the top rollers of all the fly-frames, an equipment which should enable the frames to be started with less friction, and so produce a more even roving, with fewer breakages; one-third less weight, I am told, is required on the rollers so equipped, and they will run with much less oiling, whilst the frames should require rather less power to drive them, though the difference in this last respect would perhaps be hardly perceptible.

In the spinning-room are 110 frames of 224 spindles each, driven by four motors developing about 200 h.p., 2 to 2½ h.p. being reckoned the amount required to drive a frame. Here they are spinning some 60's twist from 1⅜ in. "peeler" cotton, and 100's from 1½ in. Sea Island, tenters running 12 and 13 sides apiece, the prices paid being respectively 33s. 4d. and 34s. 4½ d., according to the number of sides minded. The New Bedford hands have also suffered a wage cut of about 10 per cent., but the spinners are better off than their fellows in a Fall River mill, who mind 10 sides of 144 spindles on similar counts and earn only 29s. 3d. On 100's the frames run at about 4,000 revolutions, but for 60's the speed is 7,000 to 8,000. There are also 27 pairs of mules with 1,632 spindles to a pair, and I notice they are of a well-known Lancashire make. A minder looks after a pair of them, but the back-boy attends to 4 to 6 pairs, there being 6 back-boys with 6 doffers to look after the 25 pairs running. Minders will earn now 70s. 10d. to 75s., though before the cut-down they would be earning more like 84s. a week. Back-boys earn about 18s. 9d. and doffers 20s. 10d., only the former being paid by the minders. Another way of working the mules is by "joiners," four of whom are employed here, two running a pair of mules between them at a wage of about 25s. to 29s. 2d. These men are not in the union, but it is found useful to employ them on starting-up or to help in

changing, and in case of trouble with the union the mules can partly be run independently of the union men.

Winders at this mill look after a side of 60 spindles, being paid, as is the custom at many mills, by "the box," and earning a weekly wage of 27s. 1d. to 29s. 2d. On the beam warpers there are only two tenters for 11 machines, assisted by two creelers; warpers are on a time wage of 33s. 4d., whilst creelers earn 25s. a week. In the weave-shed, a one-storey building lighted from the roof—not a very common arrangement for the American mill—I found a number of dobbies working on fancy striped cloths largely of the "buckle" pattern (6 to 24 harness), with weavers minding 4 to 6 looms (32in.) running at 150 to 180 picks. On fine plain goods, lawns (10½ yds.) and "linens," weavers look after six looms (32 and 40in.) running at the same speed. There were also some looms using silk weft to make "mulls," a cloth 14 to 21 yds. to the pound with 60's cotton warp and raw silk weft equivalent to 280's in cotton counts, besides a "pongee" (7 to 8 yds. to the pound) with the same warp, and weft of thrown silk equivalent to 60's in cotton. Weavers average 35s. 5d. a week on plain looms and 43s. 9d. on dobbies, whilst tacklers are paid 54s. 2d. for looking after 100 to 120 mixed looms. The extra hands employed for the whole weave shed comprise 2 weft carriers, a smash-piecer, and 2 chain boys or peggers, whilst an overseer and two second-hands supervise the department; weavers clean and oil their own looms and take their cloth to the checking clerk, who moves about the shed collecting it. In cases where cloths have to be sold as "seconds" the weaver here has to sacrifice half the difference, an arrangement by which manufacturers safeguard themselves against careless weavers, though I do not think it is enforced in many mills; the more usual method is for the overseer to call up the weaver and publicly reprimand him or her before the whole room, a proceeding which, I am told, has a very salutary effect, whilst a

repetition of the bad work, showing habitual carelessness, would lead to dismissal. The ring spinning in this mill is not assisted by any humidifying, but live steam is introduced for the mule spinning, drawing and weaving, an unpleasant contrast to the complete installation of "moisteners" which I had just seen in every room of a Fall River mill working on the same class of goods.

A journey through Connecticut brought me to a Northern mill settlement in the country and quite away from the usual surroundings of a large manufacturing city. Here are mills, flanked by handsome towers, situated in grounds planted with fir trees on the banks of the river from which is obtained a large part of the power required; the wooden frame-houses of the operatives are gathered together on the hillside overlooking the mills. The river supplies some 2,000 h.p., sufficient as a rule to drive the largest mill containing all the spinning (118,000 spindles) and a part of the looms; a steam engine of 750 h.p. drives the two smaller mills, and there is an auxiliary engine of 1,000 h.p. to supplement the large mill when short of water. The largest building, 5 storeys high with a "monitor" roof, is in the shape of a T with shortened leg, being 750 × 75 feet, with an extension 200 feet long running out at right angles from the middle. Generators supply electric light for the whole mill and power to drive the freight cars of the mill on the short track from the nearest station. The freight of cotton to the mill door is, I am told, 33½d. per 100 lb., whilst the best Pennsylvania soft coal is delivered at the mills for \$5 a ton.

The labour laws for the State are similar to those of Massachusetts, except that two extra hours are allowed in Connecticut, *i.e.*, 60 hours a week; no children under 14 may be employed, but over that age they may work in the mills if a certificate of birth is shown, whilst if unable to read and write they must attend night-school. The "help" employed here are mostly American and English,

with a few French, but without the mixture of Poles, Portuguese, etc., which one finds in the Massachusetts mills. The unions, I am told, are fairly strongly organised, but, as in Massachusetts, only the mule spinners have managed to secure a standard list. The hands live in the houses provided by the corporation close to the mills, a seven-room tenement, with four of the rooms on an upper storey, being let for £12. 10s. a year.

The spinning-room in the principal mill presents an unusual sight, for here is a room 750×75 feet, full of mules, unbroken by a single pillar, a trussed roof giving the necessary support. The mules are, I notice, by a well-known Bolton maker, and have 1,320 spindles to a pair. A large range of counts is spun, from 28's to 120's twist on the frames, and 9's to 200's weft on the mules, average counts running about 80's for both warp and weft. The hands on the mules are organised as follows:—A minder runs a pair, his average earnings amounting to 62s. 6d. a week; back-boys (12s. 6d. and 25s.) look after one or two pairs, whilst there is a doffer (27s. 1d.) to about 6 pairs; three section hands (50s.) piece bands, adjust and set the parts for 32 pairs. The minder's work is largely piecing, and he does not have to pay any of the hands who assist him. Ring spinners mind on an average 8 sides of 90 spindles, though a number are working on 10 sides; if the rate of payment given me, viz., $\frac{66}{100}c.$ per spindle, is correct, then the ring spinners were only earning the remarkably low wage of 19s. 9½d. on 8 sides. Warpers, earning 35s. 5d. to 37s. 6d., look after four machines each, with the help of a "tier-over" to about a dozen machines. In the weave-rooms, weavers have mostly 6 plain looms each on fine goods, the 40in. loom running at 170 picks, and on this work I am told they will average 41s. 8d. a week. The looms are all underpick and driven from below, as is the American custom, and they are equipped with a positive let-off motion, but there are

no drop-wires on the warp. Weavers clean and oil their own looms, fetch their weft, and take their cloth to the cloth-board—work as a rule relegated to other hands. Tacklers earning about 54s. 2d. have 112 looms each, whilst the only extra hand is a smash piecer to 1,043 looms. There is also a great variety of fancy work on dobbies, and some cloths are woven with silk weft.

PART II.

THE SOUTH.

I.

CONDITIONS IN THE SOUTH.

A PRINT CLOTH MILL.

Phenomenal growth of cotton manufacturing in the South during last decade—Extension of firms already established—Water power—Labour question—Hands “green” and scarce—Negro unsuited for mill work—Children and labour laws—A strange fallacy—Financial position of Southern mills—Mill building in the country—A typical South Carolina mill settlement—Cost of building—Institutions and tenements—Long hours of work—Spinning prices compared with Lowell—Plain and automatic looms—Working more economical than at Burlington.

ONE of the most remarkable features in the industrial history of the Southern States has been the phenomenal growth of cotton manufacturing there, especially in the four States of North and South Carolina, Georgia and Alabama, during the last decade; from 1880—1890 the number of spindles increased twofold, from 422,807 to 1,195,256, whilst in the following decade the growth was still greater, even on a larger basis of calculation, for the total number of spindles in 1900 was 3,791,654, an increase of 217 per cent. For the first time in the history of the cotton industry the Southern mills in 1903 consumed more cotton than the mills of the North, but the latter are, of course, working on higher counts. The fact that, after

such a marvellous growth during two decades, the expansion of old and the erection of new mills still goes on, is ample evidence of the success of the enterprise, and it is significant that a large part of the increase of late has been solely in the enlargement of firms already existing; thus, of the total 817,826 spindles installed or projected during 1903, 526,946, or about 64 per cent., are credited to mills already established in the South.

The earliest Southern mills were not in all cases up-to-date concerns, some of them being equipped with discarded machinery from the North, but manufactures quickly learned the lesson of the importance of high-class machinery, and the present-day mills of the South will compare most favourably with Northern factories, and, as a whole, have probably more modern equipments. Water in 1900 contributed 34·8 per cent. of the total power used in the industry in North and South Carolina and Georgia; the last-named State in particular possesses enormous water powers as yet untapped, which will probably come into further use, as the employment of electricity as motive power renders the location of the mill at the foot of the falls no longer necessary. A number of the Southern mills have been, or are about to be, equipped with an electrical drive, with the power derived from a steam plant or from a river.

The hands employed at the Southern mills—except in the oldest established centres such as Augusta and Columbus, Ga.,—consist largely of what is locally termed “green help,” *i.e.*, those who have not been accustomed to working in factories all their lives, but have come there direct from the farming districts; at a Georgia mill, which I shall describe later, I was told that probably not 10 per cent. of the hands had been in a factory before, but this does not seem to be a serious drawback, as they are quick to learn. At the time of my visit to the South there was a scarcity of labour for the mills of South

Carolina and Georgia, where is the largest concentration of Southern mills, partly owing to the rapid growth of factories down there, partly to the fact that the high price of cotton was attracting the hands back to the farms again; this state of affairs will probably right itself, for if the scarcity becomes severely felt I am told there is a large reserve of help, still almost untapped, in the mountain regions of Kentucky and neighbouring States. Besides, should success attend the scheme of inducing emigrants from Southern Europe to take up farm life in the South, more of the native hands might be released for factory work. The negro does not enter into the labour question in the Southern mills, as he has been tried and found wanting, and, in fact, it is only in the picking-room and dye-house, or as an occasional sweeper that he is found inside the walls of the mill. There are many reasons for this, but the chief one is probably that his temperament is not suited to such work. An intelligent negro, questioned on this subject, replied that he thought there would be more "coloured folk" in the mills if they could sing over their work; here in a crude form we have in all probability the true explanation, viz., that the negro intellect is dulled by the noise and monotony of work on mill machinery, and the regular work and lack of change do not suit him. For several reasons, too, the negro requires a great deal more supervising than he would be worth.

The child-labour question has raised a good deal of adverse criticism, but a tour of the Southern mill centres leaves one with the impression that the case has been much exaggerated. Naturally, with an industry growing at such a rapid rate, some cases have arisen where there has been an absolute dearth of labour, and the manufacturer has been compelled, from necessity, not choice, to engage whole families, including young children; but I believe in many cases the fault has been with the parents, who have insisted on employment being found for their children as

well as themselves. However, one fallacy still flourishes, of which I will give an instance, viz., that of allowing the hands to bring in their little brothers and sisters to help them in the mill. Walking through the spinning-room of a South Carolina mill, I noticed a tiny little girl of apparently eight or nine years working on one of the frames, and, turning to the manager, remarked that there seemed to be one or two rather young hands in the mill. "See here," he said somewhat sharply, for I had touched a sore spot, "you fellows come down here and see a girl like that working here, and then write a pathetic article to the Northern papers about our employing very young children; that girl is simply helping her sister, and we aren't employing her at all." Argument in such a case was useless, but, strange to say, this is a point on which the Southern manufacturer is peculiarly blind. Nearly all the Southern States, Georgia excepted, have now on their statute books laws prohibiting the employment of children under a certain age in mills, twelve being the minimum in Alabama, Arkansas, North Carolina, Virginia and Texas, whilst in South Carolina it is at present eleven; however, I believe I am right in saying that only Tennessee and Kentucky, which fix the minimum at fourteen years, have inspectors to see that the law is enforced.

As regards the financial position of the Southern mills, one hears various and conflicting reports, but the generally accepted opinion seems to be that the chief weakness is in the lack of working capital, the mills being short of credit at the start and having to borrow at a high rate of interest from a commission house. In starting a new mill, where they are short of capital, it is, I understand, quite a common thing for the textile machinists to take stock largely in payment for their machinery, though some makers are far more particular in this respect than others and will only take stock in an absolutely solid concern. At a South Carolina print-cloth mill I was told that

62 per cent. of the stock was originally held by Northern machinists, but that by now it had all come South again and was held to a large extent locally.

In mill building down South the tendency is to avoid the towns and construct an entirely new settlement out in the country, one reason being that thereby the managers secure complete control over their hands and freedom from outside interference. The hands, too, I am told, coming largely, as they do, from the farms, prefer to stay in the country; another item to be considered is the marked saving—about half—in rates secured by keeping outside the town limits; again, there are fewer attractions to take the “help” from their work, and there is freedom from any town epidemics. Accordingly, one comes across many villages out in the country which have sprung up around and solely by reason of the establishment of a cotton mill away from the towns.

A thing that strikes one about the Southern mill is that it has been built to suit its equipment, and also that in many cases the foresight has been shown to make provision for housing an extended plant without having to add separate buildings, a process which in extreme cases has necessitated waggons or trains going all day to keep up communications between different buildings. A common type of the Southern mill is a four-storey brick building divided into two unequal portions by fire-proof walls enclosing the belt or rope drive, the elevator, stairs, closets, etc. The top floor, lighted by a monitor roof in the case of a large room, holds the spinning and in the smaller portion winding and warping; below, in the two divisions, come carding and picking, on the second floor weaving and slashing, and on the ground floor the remaining looms and the cloth-room.

On a fine open moorland, several miles out from the nearest town, I came across what may be considered a

typical South Carolina mill settlement, grown up during the last three years around a small mill of some 25,000 spindles and 600 looms engaged in print-cloth production and dobby weaves. The mill was built at a cost of \$28.65 a spindle, but as it includes space for 15,000 more spindles and a corresponding amount of looms, the cost, when the mill is completely equipped, will figure out at something like \$16 a spindle; this price includes some 218 acres of land, the mill building, its plant and power, tenements for the hands and other buildings. Settled, as one might say, away from civilisation, it is incumbent on the mill authorities to provide many institutions which would be found naturally in a town, and, in every case I have seen, they do not seem to have been at all lacking in enterprise or generosity in this direction. These mill settlements have their one or two churches, according to their size, or perhaps, as in this case, an auditorium for lectures and religious meetings, whilst the school must, I believe, be built before the State will support it, and even then only for a part of the time; the State supplies enough to run the school here for four months, but as it was kept open for eight months last year, it naturally required support from the mill. A manager is put into a general store run by the firm, and anything in the way of food, also furniture, hardware and all but the best tailor-made clothing can be bought from this country "Whiteley" at prices current in the nearest town. Wages are only paid fortnightly, with two weeks' earnings held in hand—the usual arrangement, I found, in the South Carolina mills—but advance coupons are given to those really in need and are as good tender as money at the store.

The wooden tenements (4, 5 and 6 rooms), standing up from the ground on brick perches, are let for 2s. 1d. per room per month, and obtain their supplies of water from outside wells, for there is no system of piping for water or sewage in the village. A glance round the inside of one,

devoid of paint, paper, or plaster, very poorly furnished and somewhat untidy, did not impress one very favourably; the Lancashire operative would probably despise such dwellings, but at the same time the country surroundings and clear, fresh atmosphere are far more congenial, as a set-off against the crowded English factory town. The hours of work for South Carolina, as fixed by law, are 66 per week, arranged as follows to give a half-day free on Saturday:—6 to 12 and 12-45 to 6-45, with Saturdays 6 to 12. At first sight twelve hours a day may seem somewhat heavy working, but the American hands do not, I am told, work continuously day in and day out, but take a day off from time to time for rest or holiday, their places being taken by a number of "sick-help" from the village; the best paid help, especially weavers, are those who most frequently take a day off, but whether the children enjoy this occasional relaxation I am unable to say. The factory law of the State in regard to children forbids their employment in mills under the age of 10 up to May 1st, 1904, and under 11 after that date, whilst on May 1st, 1905, the minimum will be 12, but if there are no inspectors to enforce it, it is not of any very great value.

The counts spun at this mill vary from 29's to 40's, and spinners are given 8 sides of twist and weft mixed; the frames, driven by what I have described as the "Fall River Drive," have each 224 spindles, and spinners are paid 4d. a side on warp and $4\frac{1}{2}$ d. on weft, or an average of 17s. weekly, as against 24s. 9d. which a Lowell spinner earns for tending 8 sides of only 104 spindles. The doffers were not in the room, I noticed, and it was explained to me that they were allowed to play outside when not wanted on their work. Coming to the weave rooms, there are 320 Drapers, 200 plain looms and 100 dobbies, the last-named, however, working mostly on prints. The 40 in. Drapers run at 158 to 160 picks, with weavers looking after 16 each, cleaning and oiling their looms and keeping their own

magazines full; plain looms of the same width have a speed of 166 picks, with beginners running four, good weavers eight, and an average of six looms apiece, weavers here also doing their own cleaning and oiling. There are two or three smash hands for each of the two rooms, and they also assist the tacklers, three of whom, with a second hand, run each room; counting the second hand as a tackler, they run about 75 looms apiece, as against 174 of the same width which the Fall River tackler looks after, an evident sign of the scarcity of skilled labour of this type for the South Carolina mill. The following prices are paid for two cloths commonly woven here:—

38½ in., 64 sq., 5d. on Drapers, 10½d. on plain looms, for cut of 65 yds. (slasher length).

40 in., 80 sq., 8½d. on Drapers, 14d. on plain looms, for cut of 65 yds. (slasher length).

The counts for both cloths are 29's twist and 40's weft. At Lawrence, it may be remembered, the rate was much higher for a cloth similar to the first, viz., 8¼d. on Drapers and 15½d. on plain looms for a 54½ yds. cut (slasher length) of a 39 in., 68 sq., cloth. Weavers here, I am told, will average 4s. 2d. to 4s. 7d. a day on 8 plain or 16 Draper looms.

The following is a rather more detailed account of the organisation in the weave-room of another South Carolina print-cloth mill containing 1,000 Draper looms:—Narrow looms here were running at 185 picks, with an average of 15½ to a weaver; good weavers were mostly on 18, and three even on 20, but a number of young learners on 13 and 14 pulled down the average. The extra hands consist of a boy, at a wage of 18s. 9d., who cleans and oils 200 looms and sweeps the floor; two weft carriers at the same wage, and a smash hand at 25s.; tacklers, at \$1.50, \$1.55, and \$1.60 a day, look after only 90 looms each. For a 28 in., 64 × 60 cloth, with 29's twist and 39's weft, 4d. is

paid for a cut of 52 yds., and weavers will, I am told, obtain a production of $96\frac{1}{2}$ per cent. of the theoretical maximum on the 66 hours' work, without any assistance in keeping the magazines full. If we compare with the conditions at Burlington, Vt., we find that weavers were paid $4\frac{2}{3}$ d. for 50 yds. of a similar cloth (64 sq.) and only obtained 92 to 95 per cent. production on looms running at a slower speed, viz., 174 picks, whilst weft carriers and cleaners were less efficient and received higher wages at the Northern mill, and the cost of tackling was also, if anything, higher in Burlington; taking everything into consideration, the Southern mill has evidently a distinct advantage over Burlington in the economical working of the Draper loom.

II.

SHEETING MILLS IN SOUTH CAROLINA.

A South Carolina mill settlement—Minor industries—Total cost of mill and estate—Power—A sewerred town—Spinners' wages—Drills and sheetings for export—An unsuccessful automatic loom—The Harriman loom in Virginia—Another mill village—Wages in card and spinning rooms—Production on Draper looms.

A RIDE of some five miles from the nearest town on a private car line, built right through the pine woods, brought me to another of the South Carolina mill settlements, which had sprung up right out in the country around a mill engaged in the manufacture of the coarse goods common to the South. Here, in a clearing of the woods stands a fine four-storey brick building, adorned by two handsome stair-towers, led up to by a terrace of several elevations which, when planted with trees, will add still further to the general appearance of the mill. The present equipment of the mill, still in a state of growth and incompleteness, is 43,000 spindles and 1,300 looms, but this will be increased at a later date to some 63,000 spindles and 1,800 looms, the building having been constructed with the idea of housing an extended plant. A cotton-seed oil mill, run mainly by negroes, makes oil cakes, the oil being sold for further refining, whilst there is also a small grist mill for making corn meal, and an ice plant is to be started shortly. The mill has been running about two

years, but it must be remembered that the settlement has grown up from absolutely nothing, so that it must be a matter of time before everything is complete, and another year's work, with sidewalks and roads completed, the streets lighted and trees planted, will see a great change in the appearance of this model township. The estate comprises some 200 acres of land, costing \$2,000, and the whole settlement—mill, equipment, houses and land—cost under a million and a half dollars, which will compare very favourably, I am told, with the extravagant outlay on one or two other mills in the same State. The Company has a capital of \$600,000 and pays rates at a fraction over one per cent. for both county and State, as against the two per cent. which would have to be paid in the nearest town. In South Carolina the usual system is, I understand, to assess the corporations on sixty per cent. of the forced sale value of their stock. In front of the mill stands the power house, where two vertical engines, direct-connected to generators of 600 volts each, supply the power required to run the mill and the car line. The corporation has acquired the right to power on a river 12 to 14 miles distant, where a fall of 27 feet will develop 8,000 h.p., 5,000 of which is required for this and another mill owned by the same firm in the nearest town, whilst the rest will be sold to power users in the neighbourhood.

The total population of this settlement, supported entirely by the mill and small works run by the same corporation, comprises some 2,000 people. There is a "union" church, which the different denominations take turns in utilising, an arrangement which is said to give all-round satisfaction. A temporary building is now used as a school, but a new one is to be constructed, and the State will give it partial support after it has been built. An unusual thing for one of these Southern settlements, in my experience, is the fact that the town is completely sewered, and the better houses have water pipes in the

house, instead of the usual well or hydrant outside. Houses supplied with water and bath-tub let for 2s. 11d. to 4s. 2d. per room per month, whilst those at 2s. 6d. to 2s. 11d. are without them, and tenants have to make use of the outside hydrant. Boarding, I am told, costs 41s. 8d. to 50s. a month, the latter price indicating separate board.

The spinning is on the top floor of the mill, lit and ventilated from the roof, as is frequently the case in Southern mills, whilst electric arc lights are employed when necessary. Here they were using the Fall River method for driving—two frames from one belt—applying it from the roof of the floor below, a system which, I was told, shortened the life of belts considerably. On the twist frames, making 16·5's, spinners run on an average 8 sides of 99 spindles, though a few may have 10 sides if they bring a young relation to help them, whilst on weft (15's, 17's and 22's) they have also eight sides, but of 104 spindles; at 5½d. a side the weekly wages average 22s., as against 26s. 7d. which a Lawrence spinner on low counts earned for minding 6 and 8 sides of 104 twist spindles. Six boys, earning 12s. 6d. each, doff for 40 frames. Warpers at a time wage of 4s. 2d. a day, look after 4 machines each, with 3 assistants to creel for 8 machines. For the whole room, including spinning, winding and warping, there are four old men and eight boys who act as sweepers—a common feature of the Southern mill.

The mill I describe is working purely on heavy goods, drills and sheetings, for export purposes, turning out daily a production of 25,000lb. of cloth. South Carolina, it may be noted, stands high in the rank of States manufacturing for export, contributing in 1900 over 45 per cent. of the country's total export of cotton goods, whilst the Southern States as a whole made up almost 60 per cent. of the total value. The 36in. looms at this mill run at 172 picks, and good weavers average 8 looms apiece, earning 4s. 8½d. a day on drills and 4s. 4d. on sheetings. Friday noon is the

time for cleaning, and weavers have both to clean and oil their own looms, sweepers being provided for the floors only. There are the usual weft carriers and a cloth collector, whilst tacklers, earning 37s. 6d. a week, look after 100 sheeting or 80 drill looms. The following prices are paid for cloths made here:—

36in. Sheeting (4 yds.) 48 sq., $7\frac{3}{4}$ d. for a cut of 67 yds.

37in. Drill ($3\frac{1}{4}$ yds.) 68×36 , $5\frac{3}{4}$ d. for a cut of 60 yds.
Both cloths have 16's warp and 17's weft.

In the same weave-room I noticed they were using the Northrop bobbin in an ordinary shuttle, considering it more economical because of its more lasting qualities. Here also I saw them removing the attachments from some thirty automatic looms, which the makers had thought a great improvement on the old Harriman. In this new loom the cop or bobbin is enclosed in a shell which, on the weft fork operating, is pressed out of the magazine into the side of the shuttle, at the same time ejecting the spent shuttle at the back of the shuttle-box; this change is effected without stopping the loom which, working on a 40in. cloth, could be run at 175 picks. In the show-room it had appeared to work well, but a practical trial under mill conditions had found it wanting; and it remains to be seen whether the inventors can perfect it now. I understand that the makers were prepared to fit their equipment to an ordinary loom for a little over £13, including a warp stop motion itself costing £4. 3s. 4d. At a sheetings mill in Virginia I had seen a dozen of the old Harriman looms, which the makers described as obsolete, working with every satisfaction, with weavers looking after four ordinary and two automatic looms of 116 in. reed space running at 96 picks. The overseer told me they obtained a larger production than before, and he thought they could put weavers on eight Harriman looms if they got more of them.

Another South Carolina mill, on sheetings and converters

cloths, through which I went, had a plant of 60,000 ring spindles, 400 broad and 1,120 narrow looms, the original equipment having been recently doubled. Here, in a clearing of pines and blossoming peach trees, at the foot of the hills outside the city limits, was another of those mill settlements which have grown up beyond the towns in the mill sections of the State. Here again, the corporation has built a "union" church for the "help" and makes up the deficiency in supporting it, whilst a school has been provided and runs for 10 months with six teachers, the State contributing only sufficient for two teachers for 6 months. A lecture hall has also been erected and a library is now, I believe, the latest thing in contemplation. The tenements here are let for 3s. 1½d. per room per month.

At this mill I was able to obtain the following particulars about the work and wages in different departments. The card-room has a head stripper at 17s. 6d. a week to attend to 96 cards, whilst two men at the same wage each clean a half of the cards and help the head stripper when he is in their section. Besides, there are two can boys (12s. 6d.), who have to sweep as well, and a lap man. From the strippers wage alone, 17s. 6d., as against 29s. 2d., which is paid in a Lowell mill, one can get an idea of how much lower is the general scale of wages in the South as compared with the Northern mills. On the roving frames, each of 160 spindles, there are two frames to a tenter, making 4¼-hank roving for 24's warp; there are no doffers or creelers, but tenters on adjoining pairs help each other instead. I am told they will obtain a production of 108 hanks per week, which at 2½d. per hank gives them a weekly pay of 22s. 6d. On the ring frames, spinning 24's to 30's twist and 27's to 41's weft, half the room run 8 sides of 112 spindles, but the employment of a number of beginners pulls down the average to about six. At 5d. a side, the 8-side spinners will earn £1 a week. Doffers work

in sets of four to 56 twist or 42 weft frames, and are paid 1d. per side per day on the former and $1\frac{1}{4}$ d. on the latter, which figures out at 14s. and 13s. $1\frac{1}{2}$ d. per week. As is frequently the case in the mills down South, there are gangs of sweepers—boys or old men—throughout the building, eight sweepers at 1s. to 1s. 8d. a day being provided for the spinning-room alone.

The weave-room has rather an unusual lighting arrangement, the arc lamps being fitted underneath with a small inverted reflector which throws the light up to a larger one above the globe, casting a diffused light all over the room. Here all the looms are Drapers, with cotton harness and drop wires, the 60 in. looms running at 148 picks with 16 to a weaver and the 42in. looms at 172 picks with an average of 18 to a weaver. The following are two common cloths made here, with their prices:—

58 in. 56 sq., 5d. per cut of 62 yds.; 40 in. 80 sq., $7\frac{1}{2}$ d.

the counts being 30's twist and 41's weft in both cases. On the former cloth they run off 46 yds. per loom per day, on the latter 33 yds., but the shaft is kept in motion during the dinner hour, and the hands can work or not as they like. There is the usual supply of weft carriers, cleaners and oilers, but no hopper boys, though I am told some of the 20 looms (42in.) weavers have their little brothers in to help them in that way—an instance of the indirect employment of juvenile labour where the manager does not consider himself responsible.

III.

A SOUTHERN FINE GOODS MILL.

The South advancing towards finer work—Training the hands—Freights on cotton and cloth compared for North and South—Spinning compared with New Bedford — Weaving — Good tacklers apparently scarce.

THE next mill I shall describe is rather a rarity in the South, viz., a fine spinning and manufacturing mill, though probably as time goes on it will become more usual to see some of the Southern mills on finer work; the only two difficulties are those of humidity and labour, and the former is obtainable artificially, whilst in the latter case it is merely a question of a little longer time in training the hands. The South, as is well known, is gradually advancing towards finer work, the average number having risen from 14·76 to 17·04 during the decade 1890 to 1900, and her latest efforts show that it is not beyond possibility for her to produce goods approaching in some degree the fineness of those of the Northern mills. At a North Carolina yarn mill, spinning 40's to 80's, I was told they had in three weeks taught an illiterate girl to mind a comber as well as any Northern tenter, so that the question of unskilled labour seems to be one merely of patience and a little extra time. At Columbus, Ga., one of the oldest cotton centres in the South, they spin 100's and will go up to 120's shortly, but here they have hands who have been in the factories for a long time. In a pamphlet issued by

the Greater Georgia Association, the president of the above mill says on this point:—

“We did not have to bring any of the labour from New England. The bosses were brought here, as this was a new venture in making fine yarn; but none of the operatives themselves were imported. In other words, it is all local help, and I think all the Northern superintendents concur in the belief that the help at Columbus, Ga., is as good as any in the world. There is no more trouble teaching them than at any other point. In fact, it is far better than the average help in New England, which is now mostly foreign emigrants. It takes generally about one year to take an absolutely green hand and educate him up to the standard of fine work. Or, in other words, it takes no longer here than anywhere else. In localities like Columbus, where a generation or two preceded the present help, who have been engaged in this particular line of business, whose minds have been directed to this work, whose thoughts have been about manufacturing, whose nerves and muscles have been adapted, by selection and use to this work, and where people are native born and understand the climate, the surroundings and associations, it is no exaggeration of facts to say that the help is as good as the best. The only thing it needs is to be taught what is required.”

To return to the original mill I was about to describe—its locality I should prefer not to disclose—there is a plant of 18,368 spindles and 350 looms, to be doubled later, and I am told quite three-quarters of the hands are from coarse goods mills, and have probably never worked on counts much over 20's before; it will be seen that they are able in most cases to look after a fair number of machines, though the mill has scarcely been running seven months. All the machinery will be speeded up when the hands

become more skilled at the work. The cotton used here comes from Mississippi, Alabama and Arkansas, and costs very little less than the Northern mills have to pay for it, the slight advantage disappearing on consideration of the cost of sending the cloth North to the bleacheries. On this point a Georgia coarse goods mill furnished me with the following estimate as to freights for the Northern and Southern manufacturer on raw cotton and cloth, the latter being sent to New York:—

	Mass. manufacturer.			Ga. manufacturer.		
	s.	d.		s.	d.	
Freight on cotton	2	8½	.....	1	8	per 100 lb.
do. cloth	0	8	.....	2	3½	do.
	<hr/>			<hr/>		
	3	4½		3	11½	

In the picking-room at this mill they use the three-blade beater on all but the first scutcher, and consider its combining action preferable to the more violent 2-blade beater. In the card-room there is one man to clean 21 cards and look after the laps and cans, whilst he is also learning to grind; another strips and grinds, oiling the pickers, cards and drawing frames, each man earning \$1 a day. The cards put through about 70 lb., or 3 bales of cotton for the whole room, in a day of 11 hours. The jack frames, 192 spindles in length, are producing 12 and 14-hank roving for warp and weft respectively, and tenters have three frames each, doing their own creeling, whilst there are two or three doffers to assist for the whole room. Good spinners, I am told, look after 8 sides of 112 spindles, running at 9,000 revolutions, on twist (55's) or weft (76's), and the price paid, 5d. a side, figures out at a weekly wage of 20s.; the New Bedford spinner, it may be remembered, minded 12 sides of 112 spindles, the rate being rather over 5½d. a side, but the production was probably larger as well

as the number of sides tended, in comparison with the Southern spinner. The weft count here is spun from $1\frac{1}{4}$ in. "Benders" cotton uncombed, which is bringing it down rather fine, but some three turns extra are put in over and above the ordinary rule. Doffers, paid 10s. a week, are worked in sets of four, one set running 8960 twist spindles and another 9408 weft spindles.

Winders are paid 4d. for keeping up with a side of spinning, and as the best keep up with 1,120 spindles they will earn 20s. a week. One girl tends the fronts of the five warpers, running at a drum speed of 41 revolutions, with the assistance of a girl to creel for the lot; the output for 12 hours, I am told, is 24,000 yds., and the warper earns 31s. 3d. In the weave-room are 350 40-in. looms running at 152 picks, but they are to be speeded up to 160 when the hands are more practised; at present weavers are looking after 6 to 8 looms apiece, quite half of them being on the larger number, and they have to clean their own looms. There is an oiler provided, attending to the looms and shafting, and the other "help" includes a smash girl, a weft carrier and four tacklers. Apparently the tacklers are hard to get, for it will be noticed they are looking after only 87 as against about 120 looms which a Fall River tackler runs. The looms are all weaving a 36in. 72×60 plain cloth (10 yds. to the lb.) with 55's twist and 76's weft, for a 55 yds. cut of which a price of 11d. is given; on 8 looms, weavers earn an average of 5s. 10d. a day. All the looms are, I notice, fitted with friction pulleys and brakes which, for fine goods on a fast reed loom, is considered here the best way of securing an instantaneous knock-off, besides causing less wear on the belt. The relative humidity of the weave-room is 80 per cent., and I understand this is about the standard which they try to keep by means of the humidifiers, whilst the normal temperature is about 75° .

IV.

A GEORGIA SHEETING MILL.

A Georgia mill settlement—Cost of building—Better tenements—Mill institutions—Mutual agreement as to employment of children—Work and wages—Large array of extra labour in weave rooms—Packing for export—Comparative costs of production on plain and automatic looms—The Draper loom suitable to Southern conditions.

IN the heart of the peach-growing district of the Georgia hills I visited another settlement, where on the site of an old cotton plantation had grown up, since 1896, mills containing over 3,000 looms and a corresponding amount of spindles, the whole estate now occupying some 1,500 acres, with a population of nearly four thousand. There are two main buildings, each three storeys high, situated on either side of the creek which runs through the village, and scattered around are the wooden tenements which house the population of this mill settlement. The original mill, started in 1896 with 33,000 spindles and corresponding looms, was built and equipped at a total cost of £5. 12s. 6d. per spindle, this price including all the houses and some 400 acres of land; subsequently this was extended to include a plant devoted mostly to waste spinning, and then a new building to house an equipment of over a thousand

Draper looms was added. The tenements, I am told, cost £21. 17s. 6d. per room to build, and they are rather more substantial-looking than many I have seen elsewhere, some being finished off inside with wainscoting and plaster, some with varnished match-board separated by a layer of paper from the outside wall; two carpenters are kept at work regularly looking after these houses, which are let at the rate of a "quarter" (1s. 0½d.) per room per week. Each house is supplied with water from an outside hydrant, but there are no pipes for water or drainage inside; although there are no sewage pipes, this is a point carefully attended to, and I believe these mill settlements are, as a rule, very healthy places.

The mills here support a hospital of two rooms with a trained nurse, a hotel, a bank, two or three churches, two kindergartens, and a substantial school; the State does not provide enough to run the school more than 4 out of the 9 months during which it is open. Two general stores are rented out, lectures are arranged for, and military and baseball corps have been organised. As might be expected under such circumstances, the hands are proud of their mill and settlement and very loyal to their employers, and I am told the labour agitator meets with a rather hostile reception here. The only factory law for Georgia mills is that which limits the weekly working hours to 66, divided in the present case as follows:—5-45 a.m. to 6-15 p.m., with three-quarters of an hour for dinner, closing down for Saturday afternoon. However, most of the mills of the State, I am told, belong to the Georgia Industrial Association, the members of which have a mutual agreement not to employ children under twelve years of age; in the case of a widowed mother in poor circumstances, her child may be allowed to work in a mill between the ages of 10 and 12, provided he can read and write, as otherwise he must attend school for three months.

In the picking-room of the newer mill the cotton is

blown in direct from the warehouse outside and dropped into the hopper feeding the exhaust opener, an arrangement which I often saw in the Southern mills, saving the labour of carrying about the bales so much. Pickermen here look after the fronts of 3 openers and backs of 4 finishers, there being no intermediates, whilst two men tend the fronts of 12 finishers and weigh every lap, the uniform wage in this department being 21s. 3d. a week. A curious point was the fact that the constant splitting of laps in the older mill had been rectified only by the substitution of the Kirschner 3-blade beater for the ordinary 2-blade type, and both mills have now the former kind. In the card-rooms there is a head grinder (earning 31s. 3d) on sections of 45 cards each; strippers (21s. 3d.) look after 18 cards, also putting on the laps, whilst the can boys have the same number of cards to tend at a wage of 13s. 9d. In the spinning-room, on counts varying from 10's to 13's warp and weft, spinners average 6 sides on twist frames of 104 spindles a side, whilst on weft frames of 224 spindles they look after 5 sides each; the prices paid are 5d. and 5½d. per side for twist and weft, so that spinners' wages average 15s. and 13s. 9d. respectively. Doffers earn mostly half-a-dollar a day—excepting on waste counts, where they are paid rather more—and there are 151 of them to 248 frames.

Coming to the weave-rooms, I found there were 1,030 plain and 1,292 Draper looms working mostly on shirtings and sheetings. The 36 in. automatic looms run at 166 picks, and there are only 62 weavers to the room of 1,292 Draper, whilst plain looms of the same width making 168 picks average 6 to a weaver. On 30 in. Drapers running at 176 picks I was told most of the weavers looked after as many as 28 looms. The following is an account of the labour employed on these two sets of looms—it will be noticed what a large array the “extra help” make as compared with English weave-sheds, but it is essential in

order to carry out the plan of keeping the weavers entirely to their looms and weaving alone, so as to allow of their running a larger number of looms:—

	1,292 Drapers.				1,030 plain looms.		
	£	s.	d.		£	s.	d.
Second hand ...	1	at	3 2 6	.....	1	at	2 16 2½
Head tackler ...	1	,,	2 1 3	.....	1	,,	2 3 9
Tacklers	12	,,	1 17 6	.....	17	,,	1 17 6
Weft carriers ..	4	,,	0 19 3	.....	4	,,	0 19 3
Quill boys	3	,,	0 13 9	.....	—	—	— —
Scrubber	1	,,	1 5 0	.....	1	,,	1 5 0
Sweepers	2	,,	0 11 0	.....	4	,,	0 11 0
Cloth truckers...	1	,,	1 2 0	.....	2	,,	1 0 10½
Oilers	2	,,	1 2 0	.....	3	,,	1 2 0
Smash hands...	2	,,	1 5 0	.....	2	,,	1 5 0
Warp truckers..	2	,,	1 2 0	.....	2	,,	1 7 6

On the plain looms probably one or two of the sweepers would also act as quill-boys, *i.e.*, stripping off the yarn left on bobbins. The marked excess in the number of tacklers on the plain looms was explained by the fact that the construction of the Lowell loom did not allow of so large a warp beam being used as on the Drapers, and so there was more “gaiting up” of new beams for the tacklers.

Some of the cloths made in these mills are as follows:—

28 in., 40 sq., shirting, 12's twist, 16·6 weft, for 80 yds. cut,
2½d. Drapers, 7d. plain looms.

36 in., 48 sq., sheeting, 12's twist, 14·9 weft, for 80 yds. cut,
4d. Drapers, 10½d. plain looms.

27 in., 40 sq., shirting, 12's twist, 14·9 weft, for 80 yds. cut,
2¾d. Drapers, 6½d. plain looms.

36 in, 40 sq., A sheeting, 12's twist, 12·9 weft, for 60 yds.
cut, 3d. Drapers, 6¼d. plain looms.

Weavers, I am told, average 25s. a week on Drapers and

20s. 10d. on plain looms. Only half-price is paid for "seconds," and there is rather more faulty work turned out by the Draper looms, owing to mispicks and smashes due to the larger number of looms tended by a weaver. The cloths made here—ducks, drills, sheetings and shirtings—are largely for export, being sent to South America, Aden and China, and my guide tells me that this firm is one of the few to pay particular attention to the packing; the cloths are made up in any lengths and shape required, marked in kilos, bound with ropes, iron or copper bands, and covered with any baling desired.

A comparison of the corresponding costs of production for two rooms of plain and Draper looms on the last-named (A) sheeting may be of interest, as showing the considerable saving in labour cost with the automatic loom, an advantage which is, of course, considerably lessened, but not removed, by the increased cost of the Draper (£32. 5s. 10d.) over the plain loom (£8. 6s. 8d.). On this cloth an average production of 94 per cent. of the theoretical maximum is obtained on Drapers, whilst on plain looms the output averages 82 per cent. Taking a working year of 300 days I have put down the actual figures for working the room of 1,292 automatic looms, whilst those for the increased number of plain looms required to get the nearest production of cloth, I have obtained proportionately from the room of 1,030 looms—a method which is not absolutely accurate, as the increased number should allow of economies in the organisation of the hands; this advantage would, however, be more than counterbalanced by the extra power, space and lighting required by the larger number of looms. The estimates would figure out as follows:—

	1,292 Draper looms.	1,463 plain looms.
Output	27,720,506 yds. ...	27,712,146 yds.
Cost of looms	£41,720 16 8 ...	£12,191 13 4

	Draper looms.				Plain looms.			
	£	s.	d.		£	s.	d.	
Cost of weaving (weavers' wages)	5,775	2	1	...	12,027	16	9½	
Wages of extra hands	2,197	13	9	...	3,893	15	3	
	<hr/>				<hr/>			
	£7,972	15	10	...	£15,921	12	0½	
6% interest on cost of looms	2,503	5	0	...	731	10	0	
Depreciation—7%.	2,920	9	2	...	5% 609	11	8	
	<hr/>				<hr/>			
	£13,396	10	0	...	£17,262	13	8½	

The saving effected by the automatic loom in this case is obvious, amounting, as it does, to the considerable sum of £3,866, and there is no question of the fact that the Draper loom suits the requirements of this Southern mill.

CONCLUDING NOTE.

In the foregoing pages attention has on several occasions been called to the American system of keeping skilled hands to skilled work and giving them more machines, running at a slower speed, than is the custom in Lancashire. It is not to be assumed at once that this principle is suggested for wholesale adoption in Lancashire, as conditions here are so different; we have not the American manufacturer's problem of high wages, and labour which is scarcer and less skilled than our own. It would, however, be an interesting experiment to make a partial trial of the system, without necessarily reducing the speed of machines, if standard lists could be adjusted and unions would not block the way. On the face of it, it is not, for instance, the most economical of methods for a skilled weaver to be spending a certain percentage of her time in carrying weft and cloth, cleaning, etc., when this work could be done by unskilled labour; and the same rule would apply to other departments.

On the automatic loom question sufficient has been said to justify the conclusion that the Northrop loom has made its place in the American mills, especially in the South, where scarcity of labour makes such an invention of increased value. In the North this loom is being more gradually introduced, replacing other equipments on work to which it is adapted; in every mill visited it was said to be giving satisfaction, and I should not be surprised if better results were obtained than those shown for the Burlington mill. When considering the automatic loom question it should be noted that, outside Fall River, American manufacturers mostly run their plain looms at a much slower speed than is the case in Lancashire, so that the adoption of Northrops does not mean such a reduction

of speed as with us. It is considered that the following advantages are gained by the reduction of speed:— (1) Fewer yarn breakages, and so an improved cloth; (2) a longer life to the loom; (3) an increased efficiency for the weaver, who is enabled to run a larger number of looms, a point of unusual importance where the hands are scarce or not over skilful.

Since writing the above report a new scale of wages must be recorded for Fall River, after the 6 month's strike. Starting at a time when the price of cotton was high and the market overstocked with cloth, it was perhaps not unwelcome to the masters, who, at any rate, seem to have gone a long way towards provoking it. The employment of newer methods (larger weft bobbins, electric warp stops, larger number of looms to a weaver, etc.), was a growing grievance with the operatives, who held that for increased work they only obtained the same, or even a smaller wage, whilst on the top of a 10 per cent. reduction (in November, 1903), wages were subjected to a further "cut" of $12\frac{1}{2}$ per cent. in July, 1904. The hands have returned to work and accepted the reduction, a concession being granted in the event of the "margin" rising above a certain point, but it is doubtful if the last word has been heard on the question. It is a singular fact that the strike could have lasted so long, when not advised by the Textile Council, and when so small a percentage of the operatives concerned belonged to unions.

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